

THE DIATOMS OF THE JUKSKEI-CROCODILE RIVER SYSTEM (TRANSCAAL, REPUBLIC OF SOUTH AFRICA): A PRELIMINARY CHECK-LIST

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ABSTRACT

During the years 1972 to 1975 samples of benthic algae were collected from 22 selected river stations in the Jukskei-Crocodile River system. Some 250 diatom taxa were identified from these samples.

UITTREKSEL

DIE DIATOME VAN DIE JUKSKEI-KROKODIL RIVIERSTISTEEM (TRANSCAAL, REPUBLIEK VAN SUID-AFRIKA). 'N VOORLOPIGE KONTROLELYS

Vanaf 1972 tot 1975 is monsters van bentiese alge by 22 uitgesoekte plekke in die Jukskei-Krokodilriviersisteem geneem. Sowat 250 diatoomtaksa is in die monsters uitgeken.

INTRODUCTION

In order to preserve our South African environment and to reduce secondary pollution, eutrophication of the aquatic environment is receiving increased attention. Diatom species or differentiating groups of diatom species have been successfully used as an index of the quality of running waters (Lange-Bertalot, 1978a; 1979a; 1979b; Schoeman, 1976; 1979). However, the successful determination of water quality using diatoms as indicators is primarily dependent on the correct identification of the diatom taxa. For this reason it is considered appropriate to present this list as a summary of diatom taxa encountered in the running waters of the Jukskei-Crocodile River system. This important river system is subject to enrichment from various sources, and others working on this river system may benefit by having some reference to the extent of the diatom flora.

DESCRIPTION OF THE STUDY AREA

The Jukskei-Crocodile River system in the Transvaal embraces an area between Johannesburg on the Witwatersrand in the south and the Hartbeespoort Dam below the Magaliesberg Mountains in the north (Fig. 1). The southern catchment area is densely populated and heavily industrialised

whereas the northern part consists mainly of agricultural areas. The geology and climate of the area have been described by Allanson (1961). The Modderfontein Stream and Jukskei River receive effluents from various sources, both domestic and industrial. The upper Crocodile River, prior to its confluence with the Jukskei River, drains a predominantly agricultural area and accordingly contains water of a higher quality.

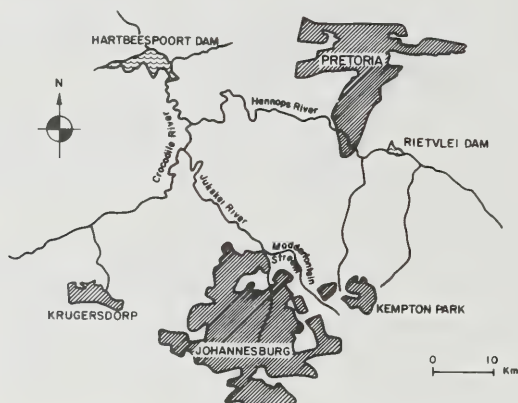


FIG. 1.
Location of the Jukskei-Crocodile River catchment area.

MATERIAL AND METHODS

Sampling Stations

Descriptions of the various sampling stations (Fig. 2) in the Jukskei-Crocodile River system are given below (Table 1). Samples were collected monthly at the various stations during the following periods:

Period	Station
March 1972—Feb. 1975	1, 2, 3, 4, 5, 6, 10, 13
March 1972—Feb. 1973	2A
April 1972—Feb. 1975	8, 9, 14
April 1972—July 1972	11
May 1972—Feb. 1975	7, 7A, 12
May 1972—Feb. 1973	11A
Aug. 1972—Feb. 1975	11B
Sept. 1972—March 1973	13A
April 1973—Feb. 1974	6B
May 1973—Feb. 1974	6A
Aug. 1973—Jan. 1975	1A



FIG. 2.
Sampling stations on the Jukskei-Crocodile River system.

Diatom analyses

Samples of benthic algae were only collected in running water (stones in current, weir overflow, etc.) and preserved with 4% v/v formalin. The diatoms in these samples were acid cleaned and mounted in Naphrax (Welsh, 1964; Cholnoky, 1968a) for microscopical examination.

TABLE 1.

Sites of the sampling stations on the main stream of the Jukskei-Crocodile River system and its tributaries

Station number	River on which station is situated	Site of station
1A	Modderfontein Stream	Above outflow from Kelvin Power Station in Edenvale.
1	Modderfontein Stream	Below outflow from Kelvin Power Station.
2	Modderfontein Stream	Below maturation dams at AECI Limited.
2A	Modderfontein Stream	Above Jukskei confluence.
3	Jukskei	Immediately above Modderfontein Stream confluence in Buccleugh.
4	Jukskei	A hundred yards downstream of station 3 below Modderfontein Stream confluence.
5	Jukskei	Weir opposite Kyalami Ranch, Kyalami on the old Johannesburg-Pretoria road.
6	Jukskei	Weir A ₂ M ₄₂ * below Leeukop Prison, Witkoppen after the confluence with the Braamfontein and Sandfontein Streams.
6A	Braamfontein Stream	On the Witkoppen road above its confluence with the Sandfontein Stream.
6B	Sandfontein Stream	On the Witkoppen road above its confluence with the Braamfontein Stream.
7	Jukskei	Below the outfall stream from Northern Sewage Works maturation ponds.
7A	Northern Sewage Works Stream	On the outfall stream below the maturation ponds.
8	Klein Jukskei	At the road bridge on the road between Broederstroom and Four Ways approximately 3 km from the confluence with the Jukskei.
9	Jukskei	Below the Klein Jukskei confluence at Woodmead school.
10	Jukskei	Weir A ₂ M ₄₄ * below station 7.
11	Crocodile	On Johannesburg-Broederstroom road.
11A	Crocodile	At Muldersdrift-Krugersdorp-Pretoria crossroads.
11B	Crocodile	Approximately 3 km above Jukskei confluence and about 50 metres above Weir A ₂ M ₄₅ *.
12	Crocodile	Between Jukskei confluence and Hennops confluence.
13	Hennops	Above (100 m) confluence with the Crocodile.
13A	Hennops	At Hennops Pride on Hartbeespoort Dam-Johannesburg road.
14	Crocodile	Immediately below Hennops confluence.

*Numbers of Department of Water Affairs measuring weirs.

OBSERVATIONS

An alphabetical list of the diatoms identified is given below. The references following each of the listed taxa are those used for their identification. An asterisk indicates that no distinction was made between the forms and/or varieties of that particular species. Illustrations and notes on the taxonomy and occurrence of the recorded taxa, as well as the relationship between the diatom associations and the water quality, will be presented elsewhere.

- Achnanthes exigua* Grunow* (Schoeman and Archibald, 1977b, No. 3)
A. hungarica (Grunow) Grunow (Hustedt, 1931–59: 383, f. 829)
A. lanceolata (Brébisson) Grunow* (Hustedt, 1931–59: 408, f. 863)
A. linearis (W. Smith) Grunow (Hustedt, 1931–59: 378, f. 821)
A. minutissima Kützing* (Hustedt, 1931–59: 376 f. 820)
Amphipleura pellucida (Kützing) Kützing (Hustedt, 1931–59: 724, f. 1095)
Amphora coffeaeformis (Agardh) Kützing (Hustedt, 1930: 345, f. 634; Patrick and Reimer, 1975: 78, pl. 14, f. 11, 12)
A. normanii Rabenhorst (Schoeman and Archibald, 1978, No. 4)
A. ovalis (Kützing) Kützing (Patrick and Reimer, 1975: 68, pl. 13, f. 1, 2)
A. ovalis var. *libyca* (Ehrenberg) Cleve (Patrick and Reimer, 1975: 69, pl. 13, f. 3–6 as *A. ovalis* var. *affinis* (Kützing) Van Heurck and *A. ovalis* var. *pediculus* (Kützing) Van Heurck
A. pediculus (Kützing) Grunow (Schoeman and Archibald, 1978, No. 4)
A. submontana Hustedt (1949a: 112, pl. 11, f. 4)
A. tenerrima Aleem & Hustedt (1951: 16, f. 3)
A. veneta Kützing (Schoeman and Archibald, 1978, No. 4; 1979, No. 5)
A. veneta var. *capitata* Haworth (Schoeman and Archibald, 1978, No. 4)
A. sp. [affin. cymbamphora] Cholnoky, 1960a: 22, f. 54; 1968b: 18, f. 17]
Anomoeoneis exilis (Kützing) Cleve (Hustedt, 1931–59: 751, f. 1114a–c)
Caloneis bacillum (Grunow) Cleve (Hustedt, 1930: 236, f. 360)
Caloneis clevei (Lagerstedt) Cleve (Hustedt, 1930: 236, f. 359; cf. Schoeman and Ashton, 1981)
C. hyalina Hustedt (1937–38: 281, pl. 15, f. 8–10)
C. schumaniana (Grunow) Cleve* (Hustedt, 1930: 239, f. 369, 370)
C. ventricosa (Ehrenberg) Meister* (Patrick and Reimer, 1966: 583, pl. 54, f. 3; Hustedt, 1930: 236, f. 362 as *C. silica* (Ehrenberg) Cleve)
Cocconeis pediculus Ehrenberg (Hustedt, 1931–59: 350, f. 804; Patrick and Reimer, 1966: 240, pl. 15, f. 3, 4)
C. placentula Ehrenberg (Hustedt, 1931–59: 347, f. 802a, b; Patrick and Reimer, 1966: 240, pl. 15, f. 7)
C. placentula var. *euglypta* (Ehrenberg) Cleve (Hustedt, 1931–59: 349, f. 802c; Patrick and Reimer, 1966: 241, pl. 15, f. 8)
Cyclotella comta (Ehrenberg) Kützing (Hustedt, 1927–30: 354, f. 183)
C. kuetzingiana Thwaites (Hustedt, 1927–30: 338, f. 171)
C. meneghiniana Kützing (Schoeman and Archibald, 1980, No. 6)
C. pseudostelligera Hustedt (1939: 581, f. 1, 2; Belcher, Swale and Heron, 1966; Genkal, 1977)
C. stelligera (Cleve & Grunow) Van Heurck (Hustedt, 1927–30: 339, f. 172)
Cymatopleura librile (Ehrenberg) Pantocsek (Schoeman and Archibald, 1980, No. 6)
Cymbella amphicephala Naegeli ex Kützing (Patrick and Reimer, 1975: 33, pl. 4, f. 11)
C. aspera (Ehrenberg) H. Peragallo (Hustedt, 1930: 365, f. 680; Patrick and Reimer, 1975: 53, pl. 10, f. 2)

- Cymbella aspera* var. *bengalensis* (Grunow in Schmidt *et al.*, 1874–1959, pl. 9, f. 12) Cleve (1894: 176). Also cf. Hustedt in Schmidt *et al.*, 1874–1959, pl. 375, f. 2, 3, 6
- C. cistula* (Ehrenberg in Hemprich & Ehrenberg) Kirchner (Patrick and Reimer, 1975: 62, pl. 11, f. 3, 4; Hustedt, 1930: 363, f. 676a)
- C. cymbiformis* Agardh (Patrick and Reimer, 1975: 54, pl. 10, f. 3, 4)
- C. ehrenbergii* Kützing (Hustedt, 1930: 356, f. 656) = *C. inaequalis* (Ehrenberg) Rabenhorst (Patrick and Reimer, 1975: 36, pl. 5, f. 3)
- C. kappii* Cholnoky (1953: 142, f. 12–14 as *C. turgidula* Grunow var. *kappii* Cholnoky, 1956: 61, f. 17–20)
- C. kolbei* Hustedt (1949b: 46, pl. 1, f. 20–26)
- C. leptoceros* (Ehrenberg) Grunow (Hustedt, 1930: 353, f. 645)
- C. microcephala* Grunow (Hustedt, 1930: 351, f. 637; Patrick and Reimer, 1975: 33, pl. 4, f. 12, 13)
- C. minuta* Hilse ex Rabenhorst (see *C. ventricosa*)
- C. ?muelleri* Hustedt (1937–38: 425; Patrick and Reimer, 1975: 43, pl. 7, f. 1, 2)
- C. naviculiformis* Auerswald (Hustedt, 1930: 356, f. 653; Patrick and Reimer, 1975: 31, pl. 4, f. 9)
- C. perpusilla* A. Cleve (Cleve-Euler, 1955: 155, f. 1232a–c; Hustedt, 1930: 361, f. 666; Schoeman, 1973: 62, pl. 1, f. 29)
- C. sinuata* Gregory (Schoeman and Archibald, 1978, No. 4)
- C. turgida* Gregory (Hustedt, 1930: 358, f. 660)
- C. ventricosa* Kützing (Hustedt, 1930: 359, f. 661; = *C. minuta* Hilse ex Rabenhorst, cf. Patrick and Reimer, 1975: 47, pl. 8, f. 1–4)
- Denticula* sp. (affin. *tenuis* Kützing var. ?)
- Diatoma vulgare* Bory* (Hustedt, 1931–59: 96, f. 628a–d; Patrick and Reimer, 1966: 109, pl. 2, f. 9)
- Diploneis oblongella* (Naeg. ex Kützing) Ross (Patrick and Reimer, 1966: 413, pl. 38, f. 8)
- Diploneis smithii* (Brébisson ex W. Smith) Cleve var. *pumila* (Grunow) Hustedt (1931–59: 650, f. 1052d, e; Patrick and Reimer, 1966: 411, pl. 38, f. 4)
- D. subovalis* Cleve (Hustedt, 1931–59: 667, f. 1063a, b)
- Epithemia sorex* Kützing (Schoeman and Archibald, 1976, No. 1)
- Eunotia pectinalis* (Dillwyn ? O. F. Müller?) Rabenhorst (Hustedt, 1931–59: 296, f. 763a; Patrick and Reimer, 1966: 204, pl. 12, f. 8, 10)
- E. pectinalis* var. *minor* (Kützing) Rabenhorst (Hustedt, 1931–59: 298, f. 763d–h; Patrick and Reimer, 1966: 207, pl. 12, f. 13, 14)
- Fragilaria brevistriata* Grunow (Hustedt, 1931–59: 168, f. 676a–e; Patrick and Reimer, 1966: 128, pl. 4, f. 14)
- F. capucina* Desmazières (Hustedt, 1931–59: 144, f. 659a–e)
- F. construens* (Ehrenberg) Grunow (Hustedt, 1931–59: 156, f. 670a–c; Patrick and Reimer, 1966: 125, pl. 4, f. 4)
- F. construens* var. *venter* (Ehrenberg) Grunow (Hustedt, 1931–59: 158, f. 670h–m; Patrick and Reimer, 1966: 126, pl. 4, f. 8, 9)
- F. fonticola* Hustedt (1937–38: 151, pl. 10, f. 61, 62). This taxon may be similar to *Synedra tabulata* (Agardh) Kützing var. *fasciculata* (Agardh) Hustedt (1931–59: 218, f. 710i–l) = *Synedra fasciculata* (Agardh) Kützing var. *truncata* (Greville) Patrick (in Patrick and Reimer, 1966: 142, pl. 5, f. 16)
- F. pinnata* Ehrenberg (Hustedt, 1931–59: 160 figs 671a–i; Patrick and Reimer, 1966: 127, pl. 4, f. 10)
- F. pinnata* var. *lancetula* (Schumann) Hustedt (1931–59: 161, f. 671m–o; Patrick and Reimer, 1966: 128, pl. 4, f. 12)
- F. ?ungeriana* Grunow (Hustedt in A. Schmidt *et al.*, 1874–1959, pl. 298, f. 1–8; Cholnoky, 1956: 71, f. 62–67; 1957a: 53, f. 89–94; cf. Foged, 1978: 64, pl. 8, f. 8–10)
- Fragilaria vaucheriae* (Kützing) Boye

- Petersen (1938: 167; Patrick and Reimer, 1966: 120, pl. 3, f. 14, 15)
- Frustulia vulgaris* (Thwaites) de Toni (Hustedt, 1931–59: 730, f. 1100; Patrick and Reimer, 1966: 309, pl. 22, f. 3)
- F. vulgaris* var. *angusta* Cholnoky (1954: 214, f. 61; Schoeman, 1973: 92)
- Gomphonema acuminatum* Ehrenberg (Patrick and Reimer, 1975: 112, pl. 15, f. 2, 4, 7)
- G. clevei* Fricke (Hustedt, 1937–38: 441, pl. 27, f. 14–18; Patrick and Reimer, 1975: 138, pl. 18, f. 6)
- G. constrictum* Ehrenberg (Hustedt, 1930: 377, f. 714) = *G. truncatum* Ehrenberg (Patrick and Reimer, 1975: 118, pl. 16, f. 3)
- G. constrictum* var. *capitatum* (Ehrenberg) Grunow (Hustedt, 1930: 377, f. 715) = *G. truncatum* Ehrenberg var. *capitatum* (Ehrenberg) Patrick (in Patrick and Reimer, 1975: 119, pl. 16, f. 4)
- G. dichotomum* Kützing (Patrick and Reimer, 1975: 135, pl. 18, f. 2, 3). Small specimens can be only 10 µm long and 3.5 µm broad
- G. intricatum* Kützing (Hustedt, 1930: 375, f. 697; Patrick and Reimer, 1975: 134, pl. 18, f. 1)
- G. intricatum* var. *pumila* Grunow = *G. dichotomum* Kützing
- G. intricatum* var. *vibrio* (Ehrenberg) Cleve (Hustedt, 1930: 376, f. 698; Patrick and Reimer, 1975: 135, pl. 18, f. 4)
- G. lanceolatum* Ehrenberg (Hustedt, 1930: 376, f. 700)
- G. lanceolatum* var. *insignis* (Gregory) Cleve (Hustedt, 1930: 376, f. 701) = *G. affine* Kützing var. *insigne* (Gregory) Andrews (Patrick and Reimer, 1975: 133, pl. 17, f. 4)
- G. parvulum* (Kützing) Kützing (Patrick and Reimer, 1975: 122, pl. 17, f. 7–12)
- G. subclavatum* (Grunow) Grunow (Patrick and Reimer, 1975: 129, pl. 16, f. 10) = *G. longiceps* Ehrenberg var. *subclavatum* Grunow (Hustedt, 1930: 375, f. 705)
- Gomphonema truncatum* Ehrenberg (see *G. constrictum*)
- G. truncatum* var. *capitatum* (Ehrenberg) Patrick (see *G. constrictum* var. *capitatum*)
- Gyrosigma acuminatum* (Kützing) Rabenhorst (Hustedt 1930: 222, f. 329; Patrick and Reimer, 1966: 314, pl. 23, f. 1–3)
- G. attenuatum* (Kützing) Rabenhorst (Hustedt, 1930: 224, f. 330; Patrick and Reimer, 1966: 319, pl. 24, f. 1)
- G. kuetzingii* (Grunow) Cleve (Hustedt, 1930: 224, f. 333). According to Patrick and Reimer (1966: 315) it is a synonym of *G. spencerii* (Quekett) Griffith and Henfrey
- G. scalpoides* (Rabenhorst) Cleve (Schoeman and Archibald, 1978, No. 4)
- G. spencerii* (Quekett) Griffith and Henfrey (Patrick and Reimer, 1966: 315, pl. 23, f. 4; Hustedt, 1930: 225, f. 336)
- G. sp.* 1 [affin. *rautenbachiae* Cholnoky] (1957b: 65, f. 61; 1959: 32, f. 167)
- G. sp.* 2 [affin. *strigilis* (W. Smith) Cleve] (Patrick and Reimer, 1966: 326, pl. 25, f. 5)
- Hantzschia amphioxys* (Ehrenberg) Grunow (Hustedt, 1930: 394, f. 747, 748)
- Melosira granulata* (Ehrenberg) Ralfs (Hustedt, 1927–30: 248, f. 104a–c)
- M. granulata* var. *angustissima* O. Müller (Hustedt, 1927–30: 250, f. 104d)
- M. varians* Agardh (Hustedt, 1927–30: 240, f. 100)
- Navicula acephala* Schoeman (1973: 107, f. 152, 153)
- N. accomoda* Hustedt (Schoeman and Archibald, 1977a, No. 2)
- N. agrestis* Hustedt (1937–38: 246, pl. 20, f. 21, 22; 1961–66: 235, f. 1358; Schoeman, 1973: 108, f. 99)
- N. anglica* Ralfs (Hustedt, 1930: 303, f. 530, 531)
- N. atomus* (Kützing) Grunow (Hustedt, 1930: 288, f. 484; 1961–66: 169, f. 1303; Schoeman, 1973: 110, f. 177–180)
- N. avenacea* (Brébisson) Cleve =

- N. viridula* (Kützing) Kützing var. *avenacea* (Brébisson ex Grunow) Van Heurck (Hustedt, 1930: 297; Patrick and Reimer, 1966: 507, pl. 48, f. 10)
- N. bryophila* Boye Petersen (Hustedt, 1961–66: 91, f. 1237)
- N. capitata* Ehrenberg (Patrick and Reimer, 1966: 536, pl. 52, f. 1, 2)
- N. capitata* var. *hungarica* (Grunow) Ross (Patrick and Reimer, 1966: 537, pl. 52, f. 3)
- N. cari* Ehrenberg (Hustedt, 1930: 299, f. 512)
- N. cincta* (Ehrenberg) Ralfs (Hustedt, 1930: 298, f. 510; Patrick and Reimer, 1966: 516, pl. 49, f. 8; Carter, 1979)
- N. cincta* var. *leptocephala* (Brébisson) Grunow (Hustedt, 1930: 299; Patrick and Reimer, 1966: 515, pl. 49, f. 7 as *N. heufleri* var. *leptocephala* (Brébisson ex Grunow) Peragallo)
- N. confervacea* (Kützing) Grunow (Schoeman and Archibald, 1980, No. 6)
- N. contenta* Grunow (Schoeman and Archibald, 1978, No. 4)
- N. cryptocephala* Kützing (Hustedt, 1930: 295, f. 496; Patrick and Reimer, 1966: 503, pl. 48, f. 3)
- N. cryptocephala* var. *veneta* (Kützing) Rabenhorst (Hustedt, 1930: 295, f. 497a; Patrick and Reimer, 1966: 504, pl. 48, f. 5)
- N. cuspidata* (Kützing) Kützing (Hustedt, 1961–66: 59, f. 1206a, b; Patrick and Reimer, 1966: 464, pl. 43, f. 9, 10)
- N. cuspidata* var. *ambigua* (Ehrenberg ?), Cleve. Not distinguished from the species, cf. Patrick and Reimer, 1966: 464.
- N. dicephala* Ehrenberg (Hustedt, 1930: 302, f. 526)
- N. digitulus* Hustedt (1961–66: 252, f. 1378)
- N. elginensis* (Gregory) Ralfs var. *neglecta* (Krasske) Patrick (in Patrick and Reimer, 1966: 525, pl. 50, f. 5)
- N. exigua* (Gregory) Grunow (Hustedt, 1930: 305, f. 538)
- Navicula fragilarioides* Krasske (Hustedt, 1930: 278, f. 461; 1961–66: 206, f. 1325)
- N. fragalis* Hustedt (Schoeman and Archibald, 1980, No. 6)
- N. goeppertiana* (Bleisch) Grunow (Lange-Bertalot and Bonik, 1978: 33; Hustedt, 1961–66: 585, f. 1592n –t as *N. mutica* forma *goeppertiana* (Bleisch) Grunow)
- N. gracilis* Ehrenberg = *N. tripunctata* (O. F. Müller) Bory
- N. gregaria* Donkin (Schoeman and Archibald, 1978, No. 4)
- N. halophila* (Grunow) Cleve (Schoeman and Archibald, 1977a, No. 2)
- N. hassiaca* Krasske (Hustedt, 1961–66: 216, f. 1332; Patrick and Reimer, 1966: 480, pl. 45, f. 17)
- N. hungarica* Grunow = *N. capitata* Ehrenberg var. *hungarica* (Grunow) Ross
- N. hungarica* var. *capitata* (Ehrenberg) Cleve = *N. capitata* Ehrenberg
- N. krasskei* Hustedt (Schoeman and Archibald, 1976, No. 1)
- N. lanceolata* (Agardh) Kützing (*sensu* Grunow in Van Heurck, 1880–85, pl. 8, f. 16; Schoeman, 1973: 134, f. 109–113; Patrick and Reimer, 1966: 511, pl. 48, f. 19, 20)
- N. menisculus* Schumann (Hustedt, 1930: 301, f. 517; Schoeman, 1973: 137, f. 122, 123)
- N. minima* Grunow (Hustedt, 1961–66: 249, f. 1374; Patrick and Reimer, 1966: 488, pl. 46, f. 17, 18)
- N. monoculata* Hustedt (Schoeman and Archibald, 1979, No. 5)
- N. muralis* Grunow (*sensu* Schoeman, 1973) = *N. perinitis* Hustedt
- N. mutica* Kützing (Hustedt, 1961–66: 583; Lange-Bertalot and Bonik, 1978: 33)
- N. perinitis* Hustedt (Lange-Bertalot and Bonik, 1976: 308, f. 1a, 2, 5, 6)
- N. pupula* Kützing (Schoeman and Archibald, 1979, No. 5)
- N. pygmaea* Kützing (Schoeman and Archibald, 1980, No. 6)
- N. radiosa* Kützing (Hustedt, 1930: 299, f. 513; Patrick and Reimer, 1966: 509, pl. 48, f. 15)

- Navicula radiosa* var. *tenella* (Brébisson ex Kützing) Grunow (Patrick and Reimer, 1966: 510, pl. 48, f. 17; Schoeman, 1973: 162, f. 119, 120)
- N. rostellata* Kützing (Hustedt, 1930: 297, f. 502)
- N. salinarum* Grunow var. *intermedia* (Grunow) Cleve (Patrick and Reimer, 1966: 503, pl. 48, f. 2)
- N. saprophila* Lange-Bertalot & Bonik (Schoeman and Archibald, 1980, No. 6)
- N. schroeteri* Meister (1932: 38, f. 100; Hustedt, 1937–38: 267, pl. 18, f. 16)
- N. seminuloides* Hustedt (1961–66: 244, f. 1369)
- N. seminulum* Grunow (Schoeman and Archibald, 1977b, No. 3)
- N. stroemii* Hustedt (1961–66: 129, f. 1262)
- N. subbacillum* Hustedt (1961–66: 117, f. 1251)
- N. subhamulata* Grunow (Hustedt, 1961–66: 126, f. 1258; Patrick and Reimer, 1966: 495, pl. 47, f. 6)
- N. subrotundata* Hustedt (1961–66: 272, f. 1402a–m)
- N. tantula* Hustedt (1961–66: 250, f. 1375)
- N. tenella* Brébisson (see *N. radiosa* var. *tenella*)
- N. tenelloides* Hustedt (Schoeman and Archibald, 1976, No. 1)
- N. terrestris* J. Boye Petersen (1915: 288, f. 7, 8; Lund, 1946: 80, f. 7M–T; Schoeman, 1969: 57, f. 27, 28, 33, 34)
- N. tridentula* Krasske (Hustedt, 1961–66: 82, f. 1223)
- N. tripunctata* (O. F. Müller) Bory (Patrick and Reimer, 1966: 513, pl. 49, f. 3). Synonym = *N. gracilis* Ehrenberg (Hustedt, 1930: 299, f. 514)
- N. twymaniana* Archibald (Schoeman and Archibald, 1977a, No. 2)
- N. vasta* Hustedt (1937–38: 273, pl. 19, f. 19–21)
- N. ventosa* Hustedt (1961–66: 234, f. 1357)
- N. vulpina* Kützing (Hustedt, 1930: 297, f. 504; Patrick and Reimer, 1966: 531, pl. 50, f. 19)
- Navicula* sp. 1 (affin. *cryptocephala* Kützing). Recorded from stations 13 and 13A
- N.* sp. 2 (affin. *twymaniana* Archibald). Recorded from stations 11B and 13
- Neidium affine* (Ehrenberg) Pfitzer (Hustedt, 1930: 242, f. 376; Patrick and Reimer, 1966: 390, pl. 35, f. 2)
- Nitzschia accomodata* Hustedt (1949a: 139, pl. 12, f. 27–31, 34, 35; Schoeman, 1973: 172)
- N. acicularis* (Kützing) W. Smith (1930: 423, f. 821)
- N. adapta* Hustedt (1949a: 135, pl. 12, f. 3–6; Schoeman, 1973: 173)
- N. agnewii* Cholnoky (1962a: 94, f. 18, 19; Schoeman, 1973: 174, pl. 6, f. 211)
- N. agnita* Hustedt (1957: 347, f. 51; Schoeman, 1973: 174, f. 212). According to Lange-Bertalot and Simonsen (1978: 16, f. 151) this taxon is a synonym of *N. pumila* Hustedt.
- N. alexandrina* (Cholnoky) Lange-Bertalot and Simonsen (1978: 16, f. 196, 197, 285, 286; = *N. elliptica* Hustedt var. *alexandrina* Cholnoky, 1958: 258, f. 29, 30; 1963: 246, f. 25–27; Schoeman, 1973: 183, f. 215)
- N. allansonii* Cholnoky (1958: 257, f. 24–27; Schoeman, 1973: 174, f. 223)
- N. amphibia* Grunow (Hustedt, 1930: 414, f. 793)
- N. apiculata* (Gregory) Grunow (Schoeman and Archibald, 1976, No. 1)
- N. archibaldii* Lange-Bertalot (1980: 44, f. 14–18, 115–121)
- N. aurantiaca* Schoeman (1973: 176, f. 204–207) Specimens may measure up to 75 µm in length
- N. bacata* Hustedt (1937–38: 485, pl. 41, f. 30–33; Schoeman, 1973: 177, f. 227). Lange-Bertalot and Simonsen (1978: 19, f. 207–209) regard this taxon as a synonym of *N. paleacea*
- N. chasei* Cholnoky = *Simonsenia delognei* (Grunow) Lange-Bertalot
- N. clausii* Hantzsch (Hustedt, 1930: 421, f. 814; Schoeman, 1973: 179)
- N. coarctata* Grunow (in Cleve and Grunow, 1880: 68; in Van Heurck,

- 1880–83, pl. 57, f. 4; Peragallo and Peragallo, 1897–1908, pl. 69, f. 26–30)
- Nitzschia communis* Rabenhorst (Schoeman and Archibald, 1977a, No. 2)
- N. confinis* Hustedt (1949a: 145, pl. 11, f. 49–54, pl. 13, f. 84–90; Schoeman, 1973: 181)
- N. denticula* Grunow (Hustedt, 1930: 407, f. 780)
- N. denticula* var. *delognei* Grunow = *N. sinuata* (W. Smith) Grunow var. *delognei* Lange-Bertalot
- N. dissipata* (Kützing) Grunow (Schoeman and Archibald, 1976, No. 1)
- N. elliptica* Hustedt var. *alexandrina* Cholnoky = *N. alexandrina* (Cholnoky) Lange-Bertalot and Simonsen
- N. filiformis* (W. Smith) Van Heurck (Hustedt, 1930: 422, f. 818; 1949a: 151, pl. 11, f. 59, 60)
- N. fonticola* Grunow (in Cleve and Grunow, 1880: 97; in Van Heurck, 1880–83, pl. 69, f. 15–19; Lange-Bertalot, 1977: 270, pl. 3, f. 7–11)
- N. frequens* Hustedt (1957: 348, f. 52–54; Schoeman, 1973: 184, f. 217, 218). Lange-Bertalot and Simonsen (1978: 23, f. 71, 72) regard this species as a synonym of *N. gandersheimiensis* Krasske
- N. frustulum* (Kützing) Grunow (Lange-Bertalot and Simonsen, 1978: 23, f. 1–39, 292, 293)
- N. gandersheimiensis* Krasske (Lange-Bertalot and Simonsen, 1978: 28, f. 40–53, 60–112, 289)
- N. hantzschiana* Rabenhorst (Hustedt, 1930: 415, f. 797; Lange-Bertalot, 1977: 263, pl. 2, f. 14–21)
- N. heufferiana* Grunow (1862: 575; in Van Heurck, 1880–83, pl. 68, f. 13, 14; Lange-Bertalot, 1977: 260, pl. 1, f. 20, 21, pl. 10, f. 5; Lange-Bertalot and Simonsen, 1978: 39, f. 232, 233 under *N. lauenburgiana* Hustedt)
- N. hungarica* Grunow (Schoeman and Archibald, 1976, No. 1)
- N. immunda* Archibald (1966: 231, f. 14)
- N. ignorata* Krasske (Hustedt, 1930: 422, f. 819)
- N. intermedia* Hantzsch ex Cleve & Grunow (Lange-Bertalot, 1977: 267, pl. 4, 5, 6; Lange-Bertalot and Simonsen, 1978: 22, f. 47, 48, 49, 51, under *N. capitellata* Hustedt; Schoeman, 1973: 186)
- Nitzschia interrupta* (Reichelt) Hustedt = *N. sinuata* var. *delognei* Lange-Bertalot
- N. kuetzingioides* Hustedt = *N. pumila* Hustedt (Lange-Bertalot and Simonsen, 1978: 38, f. 152–154)
- N. latens* Hustedt (1949a: 148, pl. 13, f. 30, 31)
- N. lauenburgiana* Hustedt (1950: 402, pl. 40, f. 6, 7, 9–11) = *N. heufferiana* Grunow
- N. levidensis* (W. Smith) Grunow = *N. tryblionella* Hantzsch var. *levidensis* (W. Smith) Grunow
- N. linearis* (Agardh) W. Smith (Hustedt, 1930: 409, f. 784)
- N. microcephala* Grunow (Hustedt, 1930: 414, f. 791; Lange-Bertalot, 1980: 51, f. 28, 29, 152–154)
- N. obligata* Archibald (1966: 233, f. 20; 1971: 52, f. 217, 218; Schoeman, 1973: 194, f. 203). This taxon is possibly a synonym of *N. agnita* Hustedt
- N. obtusa* W. Smith (Hustedt, 1930: 422, f. 817a–c)
- N. obtusa* var. *scalpelliformis* Grunow (Hustedt, 1930: 422, f. 817d)
- N. palea* (Kützing) W. Smith (Hustedt, 1930: 416, f. 801; Lange-Bertalot, 1977: 271, pl. 3, f. 17–25)
- N. paleacea* Grunow (in Cleve and Grunow, 1880: 95, as a variety of *N. subtilis*; in Van Heurck, 1880–83, pl. 68, f. 9, 10; Lange-Bertalot, 1977: 257, pl. 1, f. 5–16, pl. 8, f. 1–3)
- N. perminuta* Grunow (*sensu* Hustedt, as *N. frustulum* var. *perminuta*). Lange-Bertalot (1977: 263, pl. 2, f. 9, 10) has shown that specimens of this taxon (*sensu* Hustedt) belong to *N. frustulum* which displays a wide range of variation
- N. perpallida* Rabenhorst (*sensu* Hustedt, as *N. frustulum* var. *perpallida*). Lange-Bertalot and Simonsen (1978: 23, as *N. frustulum*) have shown that this taxon (*sensu* Hustedt) belongs to the *N. frustulum* range

- Nitzschia pilum* Hustedt = *N. palea* (Kützing) W. Smith (cf. Lange-Bertalot and Simonsen, 1978: 43)
- N. pumila* Hustedt (Lange-Bertalot and Simonsen, 1978: 45, f. 149, 150)
- N. punctata* (W. Smith) Grunow var. *coarctata* Grunow = *N. coarctata* Grunow
- N. pusilla* (Kützing) Grunow emend. Lange-Bertalot (1977: 273, pl. 7, f. 1-10, pl. 9, f. 5, 6)
- N. recta* Hantzsch (Hustedt, 1930: 411, f. 785)
- N. romana* Grunow (in Cleve and Grunow, 1880: 97 as *N. kuetzingiana* var. *romana*; in Van Heurck, 1880-83, pl. 69, f. 12; Lange-Bertalot, 1977: 269, pl. 3, f. 1-6)
- N. sigma* (Kützing) W. Smith (Hustedt, 1930: 420, f. 813)
- N. silica* Archibald (1966: 234, f. 22-24)
- N. sinuata* (W. Smith) Grunow var. *delognei* Lange-Bertalot (1980: 54, f. 77-86, 155, 156)
- N. sinuata* var. *tabellaria* (Grunow) Grunow (Hustedt, 1930: 409, f. 782; Lange-Bertalot, 1980, pl. 4, f. 75, 76)
- N. spiculoides* Hustedt (1949a: 151, pl. 13, f. 5, 6)
- N. subcapitellata* Hustedt (1939: 663, f. 109; 1957: 354, f. 63-65; Lange-Bertalot and Simonsen, 1978: 51, f. 69, 70). According to Lange-Bertalot *et al.* (l.c.) this taxon should be treated as a later synonym of *N. ganders-heimiensis*
- N. thermalis* Kützing (*sensu* Grunow; Hustedt, 1930: 403, f. 771) = *N. umbonata* (Ehrenberg) Lange-Bertalot (1978b: 648)
- N. tropica* Hustedt (1949a: 147, pl. 11, f. 34-48)
- N. tryblionella* Hantzsch (Hustedt, 1930: 399, f. 757)
- N. tryblionella* var. *levidensis* (W. Smith) Grunow (Hustedt, 1930: 399, f. 760)
- N. tryblionella* var. *victoriae* (Grunow) Grunow (Hustedt, 1930: 399, f. 758)
- N. umbonata* (Ehrenberg) Lange-Bertalot (1978b: 648, f. 1-21, 38)
- Pinnularia acoricola* Hustedt (1935: 159, pl. 3, f. 24a, b; 1937-38: 293, pl. 21, f. 11-16)
- P. acrosphaeria* W. Smith (Hustedt, 1930: 330, f. 610; Patrick and Reimer, 1966: 623, pl. 60, f. 2, 3)
- P. appendiculata* (Agardh) Cleve (Hustedt, 1930: 317, f. 570a; Patrick and Reimer, 1966: 593, pl. 55 f. 2)
- P. biceps* Gregory (Patrick and Reimer, 1966: 599, pl. 55, f. 14, 15)
- P. borealis* Ehrenberg (Hustedt, 1930: 326, f. 597; Patrick and Reimer, 1966: 618, pl. 58, f. 13)
- P. ?eburnea* Zanon (1941: 49, pl. 3, f. 16-19; Cholnoky 1960a: 108, f. 324-331; Schoeman, 1973: 207)
- P. gibba* (Ehrenberg) W. Smith (*sensu* Hustedt, 1930: 327, f. 600)
- P. gibba* var. *sancta* (Grunow) Meister (Guermeur, 1954: 64; pl. 15, f. 1a-e)
- P. interrupta* W. Smith (Hustedt, 1930: 317, f. 573) = *P. biceps* Gregory
- P. mesolepta* (Ehrenberg) W. Smith (Hustedt, 1930: 319, f. 575a; Patrick and Reimer, 1966: 600, pl. 55, f. 17, 18)
- P. subcapitata* Gregory (Patrick and Reimer, 1966: 596, pl. 55, f. 8-10)
- Rhopalodia gibba* (Ehrenberg) O. Müller (Hustedt, 1930: 390, f. 740; Patrick and Reimer, 1975: 189, pl. 28, f. 1)
- R. gibberula* (Ehrenberg) O. Müller (Hustedt, 1930: 391, f. 742; Patrick and Reimer, 1975: 191, pl. 28, f. 6; Schoeman and Ashton 1981)
- Simonsenia delognei* (Grunow) Lange-Bertalot (1979c: 132, f. 1-19)
- Stauroneis anceps* Ehrenberg (Hustedt, 1931-59: 771, f. 1120a; Patrick and Reimer; 1966: 361, pl. 30, f. 1)
- S. borrichii* (Boye Petersen) Lund (Hustedt, 1931-59: 803, f. 1151)
- S. nana* Hustedt (1931-59: 793, f. 1145; Patrick and Reimer, 1966: 363, pl. 30, f. 6; Schoeman, 1973: 229, f. 241, 242)
- S. smithii* Grunow (Hustedt, 1931-59: 810, f. 1157a-e; Patrick and Reimer, 1966: 365, pl. 30, f. 12)

- Stauroneis* sp. 1 (affin. *dahomensis* Hustedt *sensu* Archibald, 1971: 58, f. 272)
- Stephanodiscus astrea* (Ehrenberg) Grunow var. *minutula* (Kützing) Grunow (Hustedt, 1927–30: 369, f. 193d, e) = *S. rotula* (Kützing) Hendey var. *minutula* (Kützing) Ross and Sims (1978: 152)
- S. hantzschii* Grunow (Hustedt, 1927–30: 370, f. 194)
- S. rotula* (Kützing) Hendey var. *minutula* (Kützing) Ross and Sims (Hustedt, 1927–30: 369, f. 193d, e, as *S. astrea* var. *minutula*)
- Surirella angusta* Kützing (Hustedt 1930: 435, f. 844, 845, as *S. angustata*). According to Lange-Bertalot (1979a: 197) it is a synonym of *S. ovalis* Brébisson
- S. ovalis* Brébisson (Hustedt, 1930: 441, f. 860, 861; Lange-Bertalot, 1979a: 197, f. 20–24)
- S. ovata* Kützing (Hustedt, 1930: 442, f. 863, 864). Lange-Bertalot (1979a: 197) regards it as a synonym of *S. ovalis*
- S. tenera* Gregory (Hustedt, 1930: 438, f. 853)
- Synedra acus* Kützing (Hustedt, 1931–59: 201, f. 693a; Patrick and Reimer, 1966: 135, pl. 5, f. 1)
- S. acus* var. *angustissima* Grunow (Hustedt, 1931–59: 202, f. 693c). Patrick and Reimer (1966: 136, pl. 5, f. 3) treat this taxon as a synonym of *S. delicatissima* W. Smith var. *angustissima* Grunow
- S. acus* var. *radians* (Kützing) Hustedt (1931–59: 202, f. 693b). According to Patrick and Reimer (1966: 137, pl. 5, f. 4) this taxon is synonymous with *S. radians* Kützing.
- S. allansonii* Cholnoky (1958: 262, f. 33, 34; 1962b: 338, f. 46)
- Synedra fasciculata* (Agardh) Kützing. See *S. tabulata*.
- S. nana* Meister (1912: 76, pl. 8, f. 9; Hustedt, 1931–59: 212, f. 704)
- S. parasitica* (W. Smith) Hustedt (1931–59: 204, f. 695a, b; Patrick and Reimer, 1966: 140, pl. 5, f. 12)
- S. rumpens* Kützing (Hustedt, 1931–59: 207, f. 697a, b; Patrick and Reimer, 1966: 143, pl. 5, f. 19)
- S. rumpens* var. *familiaris* (Kützing) Hustedt (1931–59: 207, f. 697c; Patrick and Reimer, 1966: 143, pl. 5, f. 20). Hustedt (1957: 229) transferred this taxon to the genus *Fragilaria*, as *F. familiaris* (Kützing) Hustedt.
- S. tabulata* (Agardh) Kützing (Hustedt, 1931–59: 218, f. 710a–d; Patrick and Reimer, 1966: 141, pl. 5, f. 17, 18, as *S. fasciculata*)
- S. tabulata* var. *fasciculata* (Kützing) Hustedt (1931–59: 218, f. 710i–1) = *S. fasciculata* (Agardh) Kützing var. *truncata* (Greville) Patrick (in Patrick and Reimer, 1966: 142, pl. 5, f. 16). This taxon may be similar to *Fragilaria fonticola* Hustedt
- S. tenera* W. Smith (Hustedt, 1931–59: 211, f. 703; Patrick and Reimer, 1966: 137, pl. 5, f. 5)
- S. ulna* (Nitzsch) Ehrenberg* (Hustedt, 1931–59: 195, f. 691Aa–g; Patrick and Reimer, 1966: 148, pl. 7, f. 1, 2). In the present study no distinction was made between the various forms and varieties of this taxon
- Thalassiosira fluviatilis* Hustedt (Schoeman and Archibald, 1977a, No. 2)

*Note: The relationship between *Synedra allansonii*, *S. nana* and *S. tenera* should be carefully examined for possible synonymy.

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